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- Office of Research and Development
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    - Mid-Continent Ecology Division, Duluth, Minnesota

In this Issue:

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Research Events

NHEERL Researchers Present at FIFRA SAP Meeting

The EPA Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel (SAP) met January 31-February 2, in Washington, DC, to consider and review scientific issues related to Common Effects Methodology developed by the Office of Pesticide Programs and the Office of Water. Following preliminary and introductory remarks, the rest of the meeting's first day was filled with presentations from five EPA researchers, four from the Mid-Continent Ecology Division (MED) and one from the Atlantic Ecology Division (AED).

- Chris Russom (MED) presented *Potential use of predictive toxicology tools in characterizing effects of chemical stressors to aquatic animals.*
- Matthew Etterson (MED) spoke on *Analysis of sensitivity distributions for estimation of acute hazard concentrations to aquatic animals.*
- Russell Erickson (MED) discussed *Extrapolation factors for derivation of acute aquatic life HC5s: emphasis on acetylcholinesterase inhibitors.*
- David Mount's presentation (MED), *Analysis of chronic toxicity data and acute chronic ratios (ACRs) in support of deriving chronic HC5s: acetylcholinesterase inhibitors,* was given by Russell Erickson.
- Glen Thursby (AED) talked about *Estimating aquatic plant community hazard concentrations for pesticide effects.*

MED contact: Dale Hoff (218) 529-5386.

St. Louis River Estuary: Area of Concern to Area of Recovery – *2012 Summit, UW-Superior, WI, March 8-9*

The second annual St. Louis River Estuary Summit provided a venue for the community, students, scientists, and natural resource managers to share information and increase collaboration on the St. Louis River. More than 150 people attended the Summit this year. Sponsors included the Lake Superior National Estuarine Research Reserve, the National Oceanographic and Atmospheric Administration, Minnesota's Lake Superior Coastal Program, UW-Extension, UW-Superior, Minnesota Sea Grant, Wisconsin Sea Grant, SEH Engineering, and BARR Engineering. Once again research scientists and resource managers came together to share information about recently completed, ongoing, and up-coming projects aimed at understanding and restoring the St. Louis River's freshwater estuary.

The restoration of the chemical, physical, and biological integrity of the St. Louis River Area of Concern (AOC) will be accomplished by implementing projects that lead to the removal of Beneficial Use Impairments (BUIs) and, ultimately, delisting the AOC. Presenters addressed how their projects fit into the BUI delisting process. Some background on this process:

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St. Louis River Estuary: Area of Concern to Area of Recovery – *continued*

The Great Lakes AOCs are severely degraded geographic areas within the Great Lakes region. There are 43 AOCs--26 in the US, 17 in Canada, 5 shared. The St. Louis River was designated an AOC in 1987. The Great Lakes Water Quality Agreement (GLWQA) charged the governments responsible for each AOC with developing Remedial Action Plans (RAPs) that identify specific management strategies to control sources of pollution, abate existing environmental contamination, and restore beneficial uses in the AOC. The GLWQA defines a BUI as a change in the chemical, physical, or biological integrity of the Great Lakes system. Nearly all of the BUIs for the St. Louis River AOC are tied to habitat loss from the extensive filling of wetlands and dredging of shallow aquatic habitat and to releases of chemicals that have contaminated the sediments and water in the estuary. Since 1861, nearly 3,000 acres of wetlands have been filled, and 4,000 acres have been dredged or deepened for navigation. The AOC also contains several sites that are known historically to contain hazardous wastes and chemical contaminants.

Many of these sites are being addressed by Minnesota and Wisconsin regulatory and resource management programs, such as hazardous waste remediation programs, or federal programs, such as CERCLA ("Superfund"). Several contaminated sites in the AOC have been or are being addressed by these programs, including the St. Louis River Interlake Duluth Tar and US Steel Duluth Works Superfund site, as well as the former Koppers Company Superior Plant. In 2006, Great Lakes Legacy Act funds, specifically designated to clean up US AOCs, were used to remediate 40,000 cubic yards of petroleum-contaminated sediment and soil from Hog Island Inlet and Newton Creek in the Wisconsin part of the St. Louis River AOC. Additionally, numerous habitat protection and restoration efforts have occurred or are underway as part of the AOC delisting process. For example, the State of Wisconsin created the St. Louis River Streambank Protection Area in 1995 after purchasing 6,900 acres of land upstream from Oliver, WI, including 5 miles along the St. Louis River and 13 miles along the Red River and its tributaries. The Nature Conservancy and State of Wisconsin recently purchased Clough Island for conservation with the help of a US Fish and Wildlife Service grant. Clean-up of historic sawmill waste has restored habitat function at Grassy Point and a current project to remove pilings and sawmill waste at Radio Tower Bay is underway. Enhancement of sturgeon spawning habitat downstream from the Fond du Lac Dam is aiding the recovery of the lake sturgeon population. These and many more projects were highlighted and discussed at the 2012 St. Louis River Estuary (SLRE) Summit.

This summit led to:

- A better understanding of who is doing what/where/when with respect to current and upcoming projects related to SLRE ecosystem science and management,
- New or expanded collaboration between scientists and resource managers,
- New application of data on important management concerns.

MED staff made one presentation at the summit:

- Bolgrien, D.W., B. Bellinger, T.R. Angradi, and M.S. Pearson. Time series analysis of water level and temperature in the St. Louis River Estuary – and displayed four posters:
  - Hollenhorst, T.P., D.W. Bolgrien, M.A. Starry, T.R. Angradi, B. Bellinger, M.S. Pearson, and D.L. Taylor. High-resolution elevation data for the Saint Louis River;
  - Ledder, T., J.C. Hoffman, V. Blazer, P. Collins, J. Lindgren, and R. Gitar. Incidence rates of fish tumors and deformities in the St. Louis River area of concern: A preliminary assessment;
  - Pearson, M.S., D.W. Bolgrien, M.A. Starry, T.P. Hollenhorst, T.R. Angradi, and D. Taylor. Shoreline classification of the St. Louis River Estuary using geographic information systems and standard landuse/landcover data sets ;
  - Stevens, K.E., J.P. Berninger, J.E. Cavallin, E.J. Durhan, K.M. Jensen, M.D. Kahl, C.A. LaLone, E.A. Makynen, M. Severson, S.Y. Skolness, L.M. Thomas, D.L. Villeneuve, and G.T. Ankley. Effects-based monitoring with caged fathead minnows: An exposure gradient case study in the Duluth-Superior harbor, USA.

Contact: Dave Bolgrien (218) 529-5216.

Round Table Discussion with EPA Region 5 Administrator

On March 22 MED held a round table discussion on the St. Louis River Estuary with Dr. Susan Hedman, Region 5 Administrator. MED staff discussed three general project areas in which ORD has worked with Region 5 to address Great Lakes Area of Concern (AOC) issues, and seeks to continue active interaction and support:

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ROUND TABLE DISCUSSION – *CONTINUED*

1. Dale Hoff spoke on the ongoing work that NHEERL/NRML/NERL has been participating in concerning contaminated sediment sites at several AOCs and other Superfund sites around the Great Lakes. ORD is currently developing more effective sediment remediation assessment techniques to better design and evaluate alternative remediation strategies. This work is found in the new Research Action Plan (RAP) in Safe and Healthy Communities.

2. Brian Hill spoke on ORD efforts to identify methods to prioritize sediment remediation and ecological restoration based on benefits to Great Lakes coastal communities. This work will be centered in the St. Louis River AOC and will quantify ecological services of restoration alternatives as well as build tools for analysis of social and economic restoration benefits. This is a cooperative effort with Region 5 and will link with contaminated sediment work. The research is being conducted in the Safe and Healthy Communities RAP.

3. Jack Kelly spoke on the development of invasive species early detection and monitoring networks that ORD (NHEERL/NERL) is conducting in the Great Lakes. This work is key to a significant deliverable identified in the Great Lakes Restoration Initiative (GLRI), which states that a monitoring network will be established by FY14. ORD methodology will be utilized as the basic organizing framework for the network that will include multiple federal and state agencies. It was initially developed in the St. Louis River AOC and is being translated to other areas under the new Safe and Sustainable Water Resources RAP.

Jeff Gunderson of the University of Minnesota then spoke on water chemistry and steel corrosion problems in the St. Louis River AOC and Great Lakes harbors. George Host of the University of Minnesota spoke on the development of community-friendly methods to educate the public on local watershed information in AOCs using iPhones and similar devices. Pat Collins of the US Fish and Wildlife Service spoke about several currently funded projects (through the GLRI) that are restoring habitat in the St. Louis River AOC. Nancy Larson, AOC coordinator for the State of Wisconsin and Nelson French, AOC coordinator for the State of Minnesota then gave an update on delisting activities that the states are conducting in the St. Louis River AOC. **Contact**: Carl Richards (218) 529-5010.

LAKE MICHIGAN: GREAT LAKES REGIONAL RESEARCH INFORMATION NETWORK

The Lake Michigan Great Lakes Regional Research Information Network (GLRRIN) was established by Sea Grant-NOAA to enhance scientific networking and data exchange among and between federal, state, and academic researchers and managers for reporting and decision-making to various groups including the Lakewide Management Plan, Great Lakes Fish Commission, and International Joint Commission, among others. A GLRRIN Work Group has been established for each of the five Great Lakes. The Lake Michigan GLRRIN held a second large conference on April 4-5, 2012. Judy Beck and Glenn Warren (Great Lakes National Program Office [GLNPO]), and Russell Kreis (ORD-NHEERL-MED-Grosse Ile, MI) attended from the EPA. Also in attendance were representatives from NOAA, USGS, Purdue University, University of Michigan, University of Wisconsin-Milwaukee, Grand Valley State University, Indiana-Illinois Sea Grant, Wisconsin Sea Grant, and Great Lakes Fishery Trust, among others.

The first day of the meeting was directed toward scientific findings, data exchange possibilities, and coordination primarily associated with the Cooperative Science and Monitoring Initiative (CSMI) in 2010, which promotes intensive lake studies on a rotational cycle. Glenn Warren and Russell Kreis presented EPA efforts and anticipated efforts regarding the Offshore Monitoring Program, Nearshore Towed-device Program, National Coastal Condition Assessment Program, Nutrient Loading Updates, and Mathematical Modeling.

Results of all studies showed that demonstrable changes have occurred in Lake Michigan over the past 15 years. Many of these changes are hypothesized to be associated with the occurrence and abundance of zebra and quagga mussels. Changes observed include: changes in nutrient fluxes and cycling dynamics, changes in ambient nutrient concentrations in the nearshore and offshore zones, decreases in phytoplankton and zooplankton standing crops, decreases in *Diporeia*, decreases in forage and predatory fish standing stocks and yields, diet changes showing increased utilization of invasive goby compared to historical food sources, and the proliferation of *Cladophora* in the nearshore zone. Overall this hypothesis encompasses changes in the nature and dynamics of fluxes, productivity, biomass, and energy, related to most Lake Michigan trophic levels.

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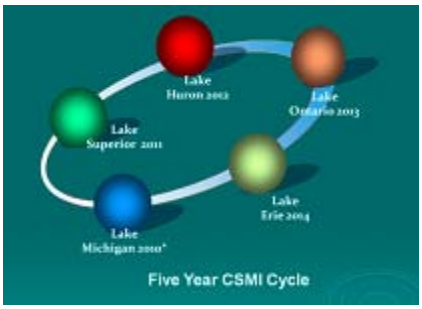
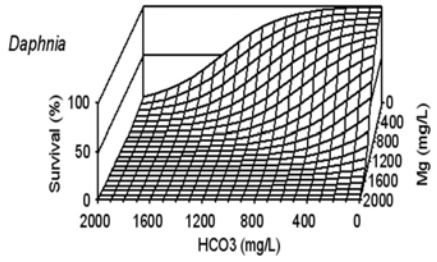
LAKE MICHIGAN – *CONTINUED*



The second day of the conference had a wider attendance with additional managers and program leaders. A synopsis of the scientific findings from the previous data and an assessment of the status of the lake were provided. In addition, breakout sessions and discussions to identify further research areas and issues were held. Primary next steps for the Lake Michigan GLRRIN group included: an annual or biennial research meeting, new Lake Michigan community investigators meetings, periodic topical meetings, enhanced communication using email lists and the Lake Michigan GLRRIN website, rotating leadership responsibilities, scientific session at the 2013 International Association for Great Lakes Research Conference and associated special supplement of the *Journal of Great Lakes Research*, and planning meetings for the 2015 Lake Michigan CSMI.
Contact: Russell Kreis (734) 692-7615.

WORKSHOP ON EVALUATING THE EFFECTS OF MAJOR IONS ON AQUATIC ORGANISMS, APRIL 2-4, EPA REGION 5, CHICAGO

In recent years, research has increased focus on the effects of major ions (e.g., Na, K, Ca, Mg, Cl, SO4, HCO3) on aquatic organisms. These ions, and associated aggregate measures like conductivity, salinity, or total dissolved solids, are elevated by a number of human activities, including resource extraction, some manufacturing processes, irrigation return flows, and stormwater runoff. While research has shown instances where concentrations of major ions in discharges have reached levels toxic to at least some aquatic organisms, this same research has also shown the complexities of assessing these effects across sites, with responses varying according to the specific ion combinations involved and the receptor organisms. The purpose of this workshop was to discuss approaches to assess the effects of major ions on aquatic organisms, including laboratory testing, field assessments, and mesocosm studies. This workshop was led by EPA (MED, Region 5, Cincinnati, DC), USGS, the IL Natural History Survey, VA Tech, University of Technology/Sydney, and NC State, with participation by other universities and businesses.



Dave Mount of MED's ETAR Branch led a Plenary Session, and presented on *Laboratory toxicity testing of multiple major ions and the development of empirical toxicity models*. Russ Hockett, Dale Hoff (ETAR), and Teresa Norberg-King (TECR) also attended.
Contact: Dave Mount (218) 529-5169.

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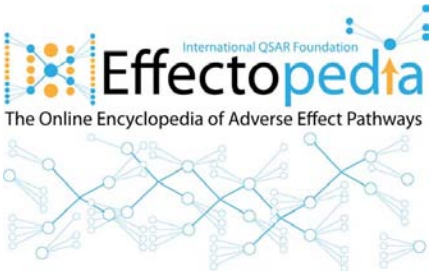
14 MED SCIENTISTS PARTICIPATE IN "EFFECTOPEDIA" TRAINING SESSION



On April 11, MED hosted an Effectopedia training workshop sponsored by the International QSAR Foundation (located in Two Harbors, MN). Effectopedia is an open source knowledge aggregation and collaboration tool intended to support the description and cataloging of adverse outcome pathway knowledge in an encyclopedic manner. Effectopedia is modeled after Wikipedia in that is intended to be an open system where users supply the content. It consists of a graphical interface in which users can "draw" a pathway by linking effects observed at different levels of biological organization. Each node in the pathway can then be annotated with a description, variables and units that describe the biological context (e.g., sex, life-stage, time to effect, tissue, etc.), and supporting references. Given that the tool will rely on a crowd-sourcing approach to review the veracity of the pathway information supplied by users, discussion and chat capabilities have been integrated into the tool to facilitate scientific debate regarding the content. The latest version of the Effectopedia software can be downloaded free at http://sourceforge.net/projects/effectopedia/.

The training session began with a general overview of the purpose of the software, its conceptual design, and its current capabilities. The overview was presented as a seminar that was attended by an audience of over 60 individuals both live and via remote access (webinar). Following the overview, 14 MED scientists and one guest from the US Army Corps of Engineers participated in hands on training. The training covered pathway searches, building and annotating new pathways, and features for providing feedback. As the software is still under development, the participants were also encouraged to take the system for a "test-drive" in order to identify "bugs" and comment on the various features and functions.

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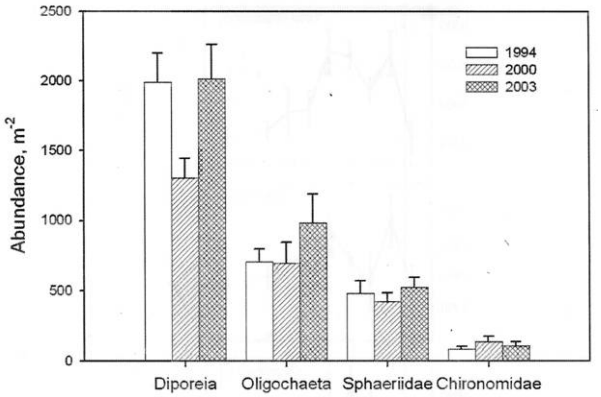
Adverse outcome pathways (AOPs) are conceptual constructs that portray existing knowledge concerning the linkage between a direct molecular initiating event and an adverse outcome at a biological level of organization relevant to risk assessment. In effect, they are used to lay out a scientifically credible rationale which can be used to link mechanistic data or predicted chemical-biological interactions to endpoints of regulatory interest/significance. Identification, description, and cataloging of AOP knowledge is increasingly viewed as a critical need to support the application of so called "21st Century" approaches to toxicity testing, which put greater focus on measurements or predictions of pathway perturbation and aims to reduce reliance on empirical observation of adverse outcomes in whole animal toxicity tests. Given the importance of AOPs in supporting this new paradigm, EPA-ORD, OECD, and other organizations both nationally and internationally have initiated efforts to coordinate and support the development of AOP knowledge. Effectopedia is being looked to as a central, open access, repository for that knowledge. The training session helps put MED scientists at the forefront of this emerging effort. **Contact**: Dan Villeneuve (218) 529-5217.

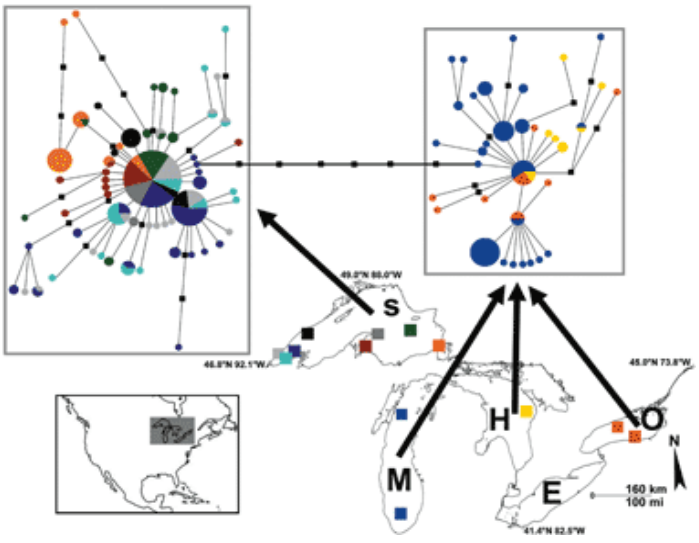
Featured Research

ECOLOGY OF NEARSHORE BENTHIC INVERTEBRATES TO SUPPORT GREAT LAKES MONITORING, ASSESSMENT, AND MANAGEMENT

MED has been conducting research to provide a better understanding of benthic macroinvertebrates, particularly the amphipod *Diporeia*, in Lake Superior to support monitoring and assessment for the Great Lakes. We demonstrated a statistically robust survey design to obtain regional estimates of benthic invertebrate distributions and coupled this with an examination of genetic diversity of *Diporeia* in Lake Superior and between the Great Lakes.



Benthic macroinvertebrates are valuable indicators of environmental condition for lakes, because their responses integrate the effects of sediment and water conditions in a localized area over a period of time. During 1994-2003 we implemented a probability based survey design to assess the biotic integrity of the US nearshore waters of Lake Superior using abundance of the amphipod *Diporeia* spp. and measures of benthic invertebrate community structure. *Diporeia* is a key component of the Great Lakes food web, and sustaining adequate populations of this amphipod is an ecosystem objective identified by the Great Lakes Water Quality Agreement (GLWQA). Our assessments showed that benthic invertebrate assemblages in Lake Superior were relatively stable during the study period. This is in contrast to the severe impacts that have been observed during this period in the other Great Lakes following the introduction of dreissenid mussels, where benthic invertebrate assemblages have been dramatically altered, and where *Diporeia* populations have declined to the point of elimination from large areas of the lakes. In fact, comparison of our estimates for Lake Superior with populations of benthic invertebrates reported in the 1970s showed a marked increase in densities of all major taxa including *Diporeia* within the nearshore zone. In 2006 the survey design was modified and expanded to cover all of Lake Superior, including both nearshore and offshore waters. This work was part of an assessment of Lake Superior's lower food web under the bi-national Coordinated Science and Monitoring Initiative, involving a partnership among EPA, USGS, Environment Canada, and the Division of Fisheries and Oceans Canada. This survey verified that the large increases in *Diporeia* populations from the 1970s to the present were primarily restricted to nearshore waters of Lake Superior.



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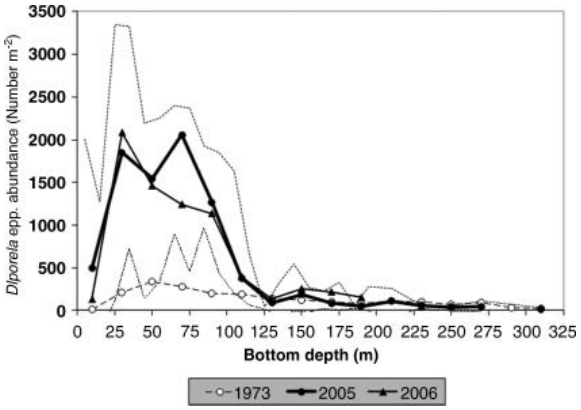
To test whether the observed changes in *Diporeia* abundance could be explained by the existence of different genetic populations, scientists from MED and NERL's Molecular Ecology Research Branch examined the genetic variability of *Diporeia* within Lake Superior. Although *Diporeia* is an important species in the Great Lakes ecosystem, its taxonomy is not well defined, being thought to comprise as many as eight species. This study revealed that the populations in Lake Superior, where densities are stable, are genetically distinct from those in the lower Great Lakes, where numbers are declining. We also found that although there are regional differences in populations within Lake Superior, the nearshore populations, which increased from the 1970s to 2003, are not genetically distinct from the offshore populations, which did not increase during this period.



A second lakewide survey of benthic macroinvertebrates was completed in 2011 using the modified design, and samples are currently being analyzed to examine trends in abundance of *Diporeia* and other major taxa. To further elucidate patterns of genetic variability within Lake Superior, genetic analyses will be conducted on *Diporeia* collected from the lakewide set of sites in 2011.

Publications resulting from this research:

Scharold, J.V., S.J. Lozano, and T.D. Corry. 2004. Status of the amphipod *Diporeia* spp. in Lake Superior, 1994-2000. *Journal of Great Lakes Research* 30(Suppl. 1):360-368.

Pilgrim, E.M., J.V. Scharold, J.A. Darling, and J.R. Kelly. 2009. Genetic structure of the benthic amphipod *Diporeia* (Amphipoda: Pontoporeiidae) and its relationship to abundance in Lake Superior. *Canadian Journal of Fisheries and Aquatic Sciences* 66:1318-1327.

Scharold, J.V., S.J. Lozano, and T.D. Corry. 2009. Status of benthic macroinvertebrates in southern nearshore Lake Superior, 1994-2003. M. and I.F. Munawar, Eds., *State of Lake Superior*, Ecovision World Monograph Series, Aquatic Ecosystem Health and Management Society, Burlington, ON, Canada, pp. 473-492.

Contact: Jill Scharold (218) 529-5194.

ADVANCING THE SCIENCE OF RIVER MONITORING AND ASSESSMENT: EMAP-GRE

Rivers are among the most impacted ecosystems on earth. In most developed countries, some streams remain in relatively pristine condition, whereas virtually every reach of the larger rivers is subjected to multiple anthropogenic stressors. Restoration and management of these resources require reliable assessments of their condition. Research in large river assessment, like research on large rivers in general, has lagged behind research on smaller systems and the state of the art for river bioassessment is not well defined. Until recently, regional bioassessments of running waters in the US were only implemented for wadeable streams and small rivers. Barriers to applying the regional bioassessment approach to large rivers include their size and habitat complexity, the history of states' focus on intra-state resources in their Clean Water Act reporting, the lack of generally accepted methods, and the difficulty of defining reference expectations for large rivers. To overcome these barriers, demonstrate large river bioassessment tools and approaches to states and tribes, and to stimulate bioassessment research on large rivers, the EPA created the Environmental Monitoring and Assessment Program for Great River Ecosystems (EMAP-GRE). EMAP-GRE was implemented on three mid-continent "great" rivers: the Upper Mississippi, Missouri, and Ohio Rivers. Field operations for EMAP-GRE were in 2004-2006.

EMAP-GRE was a large interdisciplinary program that included many state and federal partners in field operations and laboratory analysis. EMAP-GRE featured a probabilistic survey design to allow for unbiased assessments of river condition at multiple scales, and multiple biological and abiotic indicators of condition to increase the reliability of assessments. A large number of biological and abiotic indicators were measured in EMAP-GRE, including fish, macroinvertebrate, periphyton, phytoplankton, zooplankton, water chemistry, aquatic and riparian vegetation, aquatic and riparian habitat, sediment toxicity, and fish tissue contaminants.

Forty-four publications have resulted from EMAP-GRE (and associated pilot studies) with 57 authors, 29 of which were EPA authors (11 from the Division). EMAP-GRE publications may be roughly categorized as follows: methods, indicator, or metric development (17 papers); reference condition (2 papers); invasive species status (2 papers); great river ecology/stressor response (12 papers); and great river assessment (11 papers).

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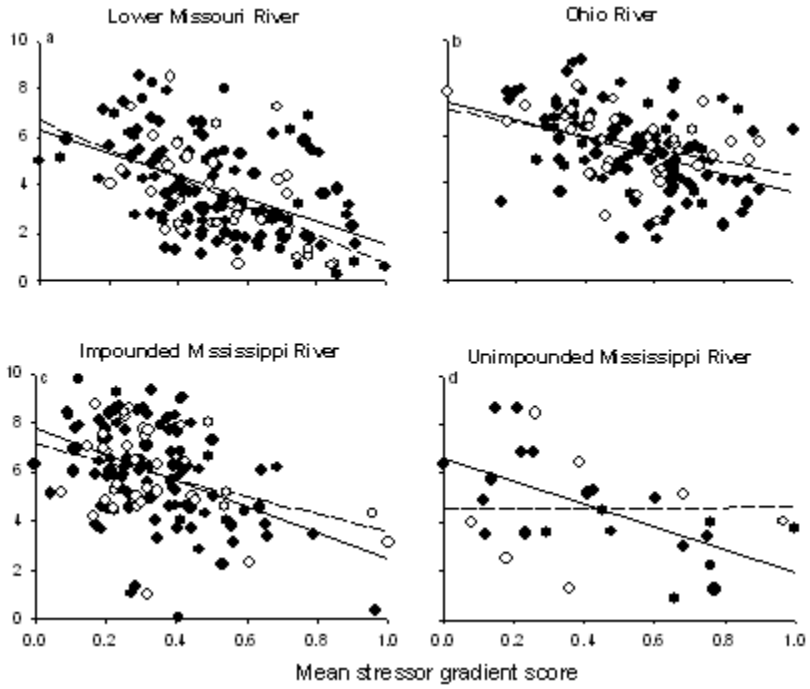
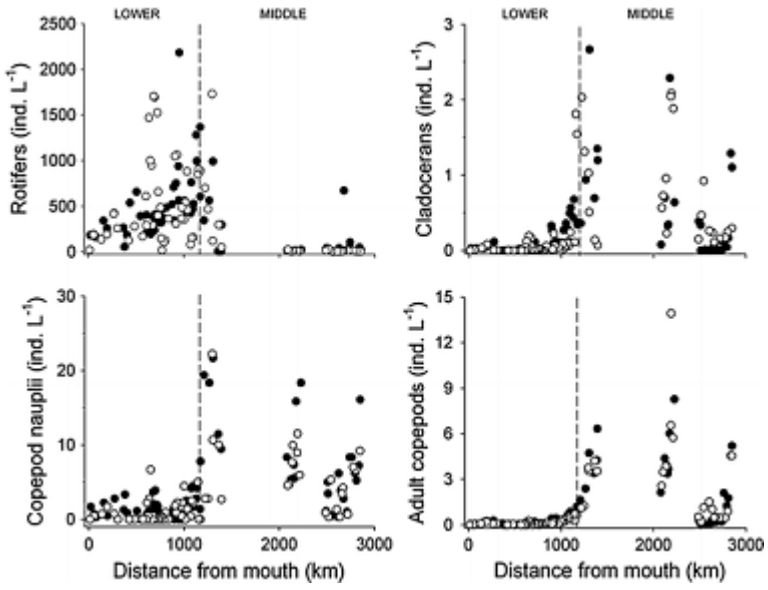
Figures from some of these papers illustrate the range of EMAP-GRE outputs.



This figure illustrates the validation of the Great River Fish Index (GRFin) a new bioassessment tool developed for EMAP-GRE assessments. Open symbols represent index development data, and filled symbols represent validation data (from Pearson, M.S., T.R. Angradi, D.W. Bolgrien, T.M. Jicha, D.L. Taylor, M. Moffett, and B.H. Hill. 2011. Multimetric fish indices for mid-continent (USA) great rivers. *Transactions of the American Fisheries Society*, 140:1547-1564.



This figure shows results from a study of zooplankton response to dams on the Missouri River. Different zooplankton groups respond differently to impoundment of the river (From Havel, J.E., K.A. Medley, K.D. Dickerson, T.R. Angradi, D.W. Bolgrien, P.A. Bukaveckas, and T.M. Jicha. 2009. Effect of main-stem dams on zooplankton communities of the Missouri River (USA). *Hydrobiologia* 628:121-135.)

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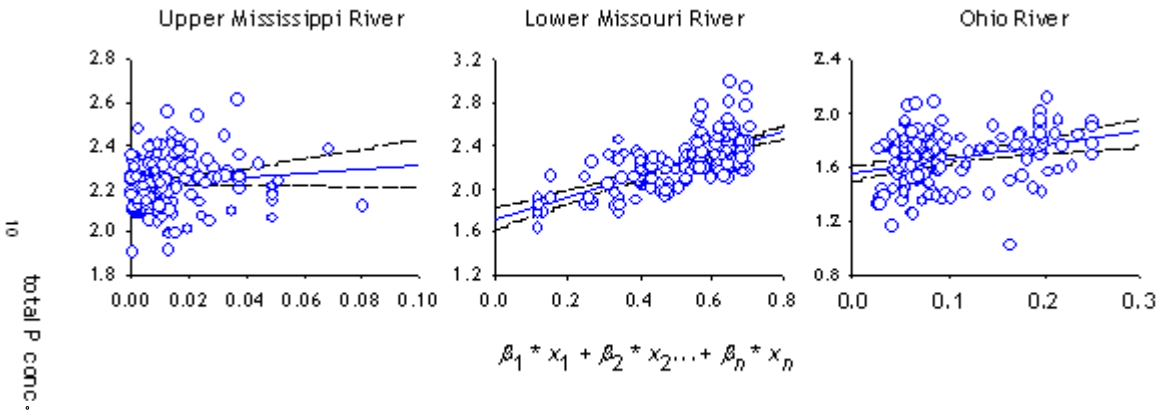
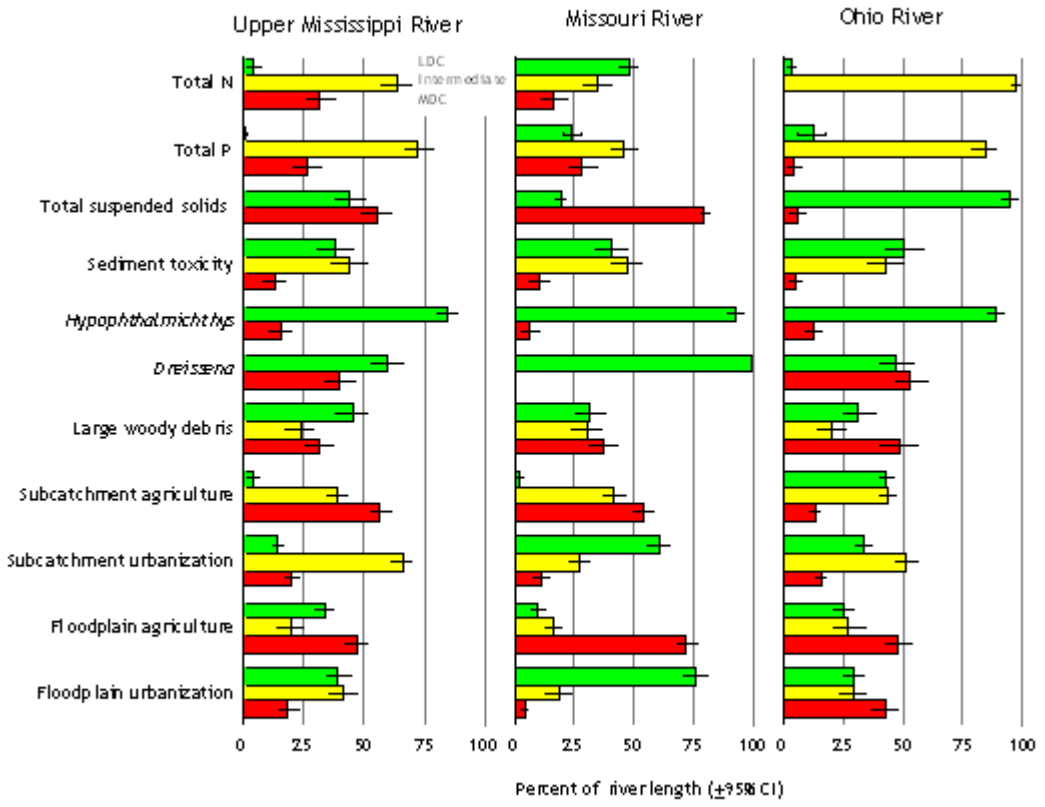


This figure shows how EMAP-GRE data can be used to predict background (reference) total P concentration in the mid-continent great rivers. Background total P concentration corresponds to the y-axis value when x = 0 (all stressors set to zero) (from Angradi, T.R., D.W. Bolgrien, and M.A. Starry. Modeled summer background concentrations for mid-continent (USA) great river water quality indicators. *Journ*



This figure shows an assessment result for EMAP-GRE. It depicts the percent of river length for each great river in least disturbed, intermediate, and most disturbed condition for a number of stressor indicators. *Hypothalmichthys* is invasive Asian carp; *Dreissena* are invasive zebra mussels (from Angradi, T.R., D.W. Bolgrien, T.M. Jicha, M.S. Pearson, D.L. Taylor, M.F. Moffett, K.A. Blocksom, D.M. Walters, C.M. Elonen, L.E. Anderson, J.M. Lazorchak, E.D. Reavie, A.R. Kireta, and B.H. Hill. 2011. An assessment of stressor extent and biological condition in the North American mid-continent great rivers (USA). *River Systems* I19:143-163)

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Selected EMAP-GRE publications (with emphasis on papers with EPA lead authorship):

Angradi, T.R., D.W. Bolgrien, and M.A. Starry. Modeled summer background concentrations for mid-continent (USA) great river water quality indicators. *Journal of the American Water Resources Association*, in press.

Angradi, T.R., D.W. Bolgrien, T.M. Jicha, M.S. Pearson. D.L. Taylor, and B.H. Hill. Multimetric macroinvertebrate indices for mid-continent US great rivers. 2009. *Journal of the North American Benthological Society* 28:785-804.

Angradi, T.R., M.S. Pearson, T.M. Jicha, D.L. Taylor, D.W. Bolgrien, M.F. Moffett, K.A. Blocksom, B.H. Hill. 2009. Using stressor gradients to determine reference expectations for great river fish assemblages. *Ecological Indicators* 9:748-764.

Angradi, T.R., D.L. Taylor, T.M. Jicha, D.W. Bolgrien, M.S. Pearson, and B.H. Hill. 2009. Littoral and shoreline wood in mid-continent great rivers (USA). *River Research and Applications* 26:261-278.

Angradi, T.R., D.W. Bolgrien, T.M. Jicha, M.S. Pearson, D.L. Taylor, M.F. Moffett, K.A. Blocksom, D.M. Walters, C.M. Elonen, L.E. Anderson, J.M. Lazorchak, E.D. Reavie, A.R. Kireta, and B.H. Hill. 2011. An assessment of stressor extent and biological condition in the North American mid-continent great rivers (USA). *River Systems* 19:143–163.

Angradi, T.R., D.W. Bolgrien, T.M. Jicha, and M.F. Moffett. 2010. Macroinvertebrate assemblage response to urbanization in three mid-continent USA great rivers. *Fundamental and Applied Limnology* 176:183–198.

Blocksom, K.A., D.M. Walters, T.M. Jicha, J.M. Lazorchak, T.R. Angradi, and D.W. Bolgrien. 2009. Persistent organic pollutants in fish tissue in the mid-continental great rivers of the United States. *Science of the Total Environment* 408:1180–1189.

Bolgrien, D.W., R. Meyer, M. Pearson, T. Jicha, T. Angradi, D. Taylor, M. Moffett, and B.H. Hill. 2010. Spatial distributions of biophysical conditions on the Ohio River. *River Systems* 19:113-128.

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Contact: Ted R. Angradi, Ph.D. (218) 529-5243, angradi.theodore@epa.gov, David W. Bolgrien (218) 529 -5216, bolgrien.dave@epa.gov.

Current Events

VISIT FROM NHEERL DIRECTOR

Hal Zenick, NHEERL Director, visited the Division from April 16-17. He is visiting all NHEERL Divisions to hear staff input on how best to keep NHEERL moving on the Path Forward. Hal was accompanied by Jonathan Garber, Associate Director for Ecology, and J'Ingrid Mathis, Senior Advisor for Workforce Planning, Development, and Advancement. Hal, Jonathan, and J'Ingrid met with staff at an all-hands, and in small groups at every level, to discuss how our science programs and our workforce can advance together to accomplish our mission in the face of challenges and change. Division researchers and management presented overviews of our research activities: watershed links to healthy ecosystems; ecosystem services, communities, and contaminated site remediation; systems biology; extrapolation tools and dashboards; new dimensions for criteria and benchmarks. **Contact**: Carl Richards (218) 529-5010.

Hal Zenick, Carl Richards, Jonathan Garber, J'Ingrid Mathis

USA Science & Engineering Festival Exhibit

The USA Science & Engineering Festival, held in Washington, DC, April 28 - 29, featured kid-friendly science exhibits on a wide range of topics. An EPA exhibit developed by MED researchers invited participants to grab a fishing rod and catch a fish. The "fish" (printed with a realistic image on one side and statistics, such as size, trophic level, and mercury concentration, on the other side) came from enclosures representing either a "healthy" or "unhealthy" coastal wetland. Participants figured out which wetland is which from the display images provided, and placed data points corresponding to their catch on a graph. The graphs illustrated how fish contaminant burdens increase with body size and trophic position and how unhealthy systems tend to have more exotic species and more species with turbidity-tolerant life histories. The data and concepts illustrated by the exhibit are based on findings from ORD research aimed at understanding environmental conditions in Great Lakes coastal wetlands. MED scientists Joel Hoffman and Anett Trebitz, worked with staff from the Great Lakes Aquarium in Duluth, MN, and from ORD's Immediate Office of the Assistant Administrator to produce the exhibit, and Dr. Trebitz traveled to Washington to help staff it.
Contact: Joel Hoffman, (218)529-5420, hoffman.joel@epa.gov.

Upcoming Events

River Quest

The St. Louis River Quest will be held May 16-17.This is the 20th anniversary of River Quest, launched by the Duluth Seaway Port Authority and other waterfront business leaders. The program provides hands-on learning activities, on the water and on land, that raise awareness of the St. Louis River ecosystem and interrelated commercial, industrial. and recreational activities. Sixth-grade students visit 12 learning stations staffed by volunteers from local businesses, government agencies (EPA, Coast Guard, Corps of Engineers), and other organizations who will cover topics ranging from pollution prevention and stopping aquatic invaders to boating safety and commercial shipping.

MED will staff a display, *Pollution and the River Watershed*, and demonstrate the Enviroscape water model, which shows the many ways various pollutants can enter water. The display will focus on non-point source pollution, and practical ways to keep our water clean.

A companion evening event at the DECC on May 14 will focus on *Cleaning up America's Rivers*, featuring Chad Pregracke, founder of the nonprofit Living Lands and Waters. His presentation is being sponsored by Sappi Fine Paper as part of River Quest's 20th milestone celebration. The MED display will be available at this event also.

For more information, contact: Adele Yorde, Port Authority PR Manager (218) 727-8525;
EPA contact: Barb Sheedy (218) 529-5192.

MED To Host HESI-Sponsored Expert Workshop

On May 15-16, the Division will host a Health and Environmental Sciences Institute (HESI)-sponsored expert workshop on adverse outcome pathways during fish early development. Specifically, the purpose of the workshop is to identify established and hypothesized adverse outcome pathways associated with early life stage mortality in fish to support the development of efficient and cost-effective chemical screening and prioritization strategies. Eight MED scientists (Gerald Ankley, Michael Hornung, Rodney Johnson, David Mount, Teresa Norberg-King, Joseph Tietge, and Dan Villeneuve) and Stephanie Padilla (Integrated Systems Toxicology Division / NHEERL) will participate in the workshop. **Contact**: Dan Villeneuve (218) 529-5217.

Fish Bioaccumulation Tests – International Work

Dr. John Nichols will be participating in a one-day invited workshop on in vivo bioaccumulation testing with fish sponsored by the Health and Environmental Sciences Institute (HESI), May 18. The goal of this workshop, which will be held in Berlin, Germany, just prior to the meeting of the Society of Environmental Toxicology and Chemistry (Europe), is to evaluate proposed new methods for conducting bioaccumulation tests with fish. The general aim of this work is to promote the development of standardized testing

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protocols that use fewer animals, reduce costs, require less time to perform, and are appropriate to the types of compounds being evaluated. In addition, Dr. Nichols will assist in teaching a one-day hands-on course on the use of in vitro methods to estimate biotransformation impacts on chemical accumulation by fish. Course participants will learn how to perform standard in vitro assays utilizing material derived from fish liver (S9 fractions and isolated hepatocytes), extrapolate resulting data to the intact animal, and then use this information as an input to predictive models of chemical accumulation. Dr. Nichols currently co-chairs the HESI Bioaccumulation Project Committee. In that capacity he helps promote and coordinate research activities occurring is several government, academic, and private sector laboratories. He conducts research on the development of improved methods for performing in vitro-in vivo metabolism extrapolations with fish (under the Chemical Safety for Sustainability [CSS] Research Plan; Extrapolation Project 6.1) and has published extensively on the topic. Those interested in more information pertaining to these activities can contact Dr. Nichols at nichols.john@epa.gov, (218) 529-5160.

New Publications since December 2011

Burkhard, L.P., J.A. Arnot, M.R. Embry, K.J. Farley, R.A. Hoke, M. Kitano, H.A. Leslie, G.R. Lotufo, T.F. Parkerton, K.G. Sappington, and G.T. Tomy. 2012. Comparing laboratory and field measured bioaccumulation endpoints. ***Integrated Environmental Assessment and Management*** 8:17-31.

Burkhard, L.P., J.A. Arnot, M.R. Embry, K.J. Farley, R.A. Hoke, M. Kitano, H.A. Leslie, G.R. Lotufo, T.F. Parkerton, and K.G. Sappington. 2012. Comparing laboratory and field measured biota-sediment accumulation factors. ***Integrated Environmental Assessment and Management*** 8:32-41.

Burkhard, L.P., C. Cowan-Ellsberry, M.R. Embry, R.A. Hoke, and K.A. Kidd. 2012. Bioaccumulation data from laboratory and field studies: Are they comparable? ***Integrated Environmental Assessment and Management*** 8:13-16.

Custer, T.W., C.M. Custer, W.E. Thogmartin, P.M. Dummer, R. Rossmann, K.P. Kenow, and M.W. Meyer. 2012. Mercury and other element exposure in tree swallows nesting at low pH and neutral pH lakes in northern Wisconsin USA. ***Environmental Pollution*** 163:68-76.

Erickson, R.J. 2012. Proposed methodology for specifying atrazine levels of concern for protection of plant communities in freshwater ecosystems. ***EPA/600/R-12/019***.

Hoffman, J.C., A.M. Cotter, G.S. Peterson, T.D. Corry, and J.R. Kelly. 2011. Rapid stable isotope turnover of larval fish in a Lake Superior coastal wetland: Implications for diet and life history studies. ***Aquatic Ecosystem Health & Management, Special Issue*** 14:403-413.

Hoffman, J.C., J.R. Kelly, A.S. Trebitz, G.S. Peterson, and C.W. West. 2011. Effort and potential efficiencies for aquatic non-native species early detection. ***Canadian Journal of Fisheries and Aquatic Sciences*** 68:2064-2079.

Hollenhorst, T.P., L.B. Johnson, and J. Ciborowski. 2011. Monitoring land cover change in the Lake Superior basin. ***Aquatic Ecosystem Health & Management, Special Issue*** 14:433-442.

Kelly, J.R. 2011. Ecology of Lake Superior: Preface and prospectus. ***Aquatic Ecosystem Health & Management, Special Issue,*** 14:329-331.

Kelly, J.R., P.M. Yurista, S.E. Miller, A.C. Cotter, T.C. Corry, J.S. Scharold, M.E. Sierszen, E.J. Isaac, and J. Stockwell. 2011. Challenges to Lake Superior's condition, assessment, and management: A few observations across a generation of change. ***Aquatic Ecosystem Health & Management, Special Issue*** 14:332-344.

Knuth, M.L. and J.R. Kelly. 2011. Denitrification rates in a Lake Superior coastal wetland. ***Aquatic Ecosystem Health & Management, Special Issue*** 14:414-421.

Kolanczyk, R.C., P. Schmieder, W.J. Jones, O.G. Mekenyan, A. Chapkanov, S. Temelkov, S. Kotov, M. Velikova, V. Kamenska, K. Vasilev, M. Manibusan, C. Olinger, R. Kent, P. Shah, A. Khasawinah, and G.D. Veith. 2012. MetaPath: An electronic knowledge base for collating, exchanging and analyzing case studies of xenobiotic metabolism. ***Regulatory Toxicology and Pharmacology*** 63:84-96.

LaLone, C.A., D.L. Villeneuve, A.W. Olmstead, E.K. Medlock, M.D. Kahl, K.M. Jensen, E.J. Durhan, E.A. Makynen, C.A. Blanksma, J.E. Cavallin, L.M. Thomas, S. Seidl, S.Y. Skolness, L.C. Wehmas, R.D. Johnson, and G.T. Ankley. 2012. Effects of a glucocorticoid receptor agonist, dexamethasone, on fathead minnow reproduction, growth, and development. ***Environmental Toxicology and Chemistry*** 31:611-622.

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Moore, M.J., H.A. Langrehr, and T.R. Angradi. 2012. A submersed macrophyte index of condition for the Upper Mississippi River. ***Ecological Indicators*** 13:196-205.

Nowack, B., J.F. Ranville, S. Diamond, J.A. Gallego-Urrea, C. Metcalfe, J. Rose, N. Horne, A.A. Koelmans, and S.J. Klaine. 2012. Potential scenarios for nanomaterial release and subsequent alteration in the environment. ***Environmental Toxicology and Chemistry*** 31:50-59.

Pearson, M.S., T.R. Angradi, D.W. Bolgrien, T.M. Jicha, D.L. Taylor, M. Moffett, and B.H. Hill. 2011. Multimetric fish indices for midcontinent (USA) great rivers. ***Transactions of the American Fisheries Society*** 140:1547-1564.

Rygwelski, K.R., X. Zhang, and R.G. Kreis Jr. 2012. Model forecasts of atrazine in Lake Michigan in response to various sensitivity and potential management scenarios. ***Journal of Great Lakes Research*** 38:1-10.

Sierszen, M.E., J.A. Morrice, A.S. Trebitz, and J.C. Hoffman. 2012. A review of selected ecosystem services provided by coastal wetlands of the Laurentian Great Lakes. ***Aquatic Ecosystem Health & Management*** 15:92-106.

Trebitz, A.S., J.C. Brazner, D.K. Tanner, and R. Meyer. 2011. Interacting watershed size and landcover influences on habitat and biota of Lake Superior coastal wetlands. ***Aquatic Ecosystem Health & Management, Special Issue*** 14:443-455.

Villeneuve, D.L., N. Garcia-Reyero, B.L. Escalon, K.M. Jensen, J.E. Cavallin, E.A. Makynen, E.J. Durhan, M.D. Kahl, L.M. Thomas, E.J. Perkins, and G.T. Ankley. 2012. Ecotoxicogenomics to support ecological risk assessment: A case study with bisphenol A in fish. ***Environmental Science & Technology, Ecogenomics Focus Issue*** 46:51-59.

Yurista, P.M., J.R. Kelly, and S.E. Miller. 2011. Lake Superior: Nearshore variability and a landscape driver concept. ***Aquatic Ecosystem Health & Management, Special Issue*** 14:345-355.

MED Seminars

January 11: Dr. Lorena Rios-Mendoza, University of WI, Superior, Dept. of Chemistry
- Quantitative analysis of POPs in plastic debris in the ocean

January 18: Drs. Gary Ankley & Mike Sierszen, MED
- AOP-based effects monitoring and exposure reconstruction: Community benefits from sustained water quality and fisheries services, goods, and benefits provided by Great Lakes Coastal Ecosystems

February 8: Pamela D. Noyes, Duke University, Durham, NC, Nicholas School of the Environment
- The toxicology of climate change: How may the dual stresses of climate change and chemical contaminant exposures impact wildlife?

February 15: Dr. James Pauer, MED, Grosse Ile, MI
- Gulf of Mexico Hypoxia Study

February 22: Drs. Michael Hornung & Joseph Tietge, MED
- Expert systems for EDSP prioritization: Systems models linking reproductive and neurodevelopmental effects to endocrine disruption

March 21: Drs. Brian Hill & Matt Etterson, MED
- Critical loads, resilience, and sustainability: a nitrogen story. Case studies in competing risks: Hg, mesothelioma, and avian collisions with anthropogenic structures

March 28: Mindy Granley, Campus Sustainability Coordinator, University of MN Duluth
- Sustainability at UMD: Progress made, lessons learned

April 4: Dr. Gary Ankley, MED
- Diethylstilbesterol (DES): An unanticipated ecological threat?

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April 11: Drs. Gilman Veith & Hristo Aladjov, International QSAR Foundation, Two Harbors, MN
- Strategy for developing adverse outcome pathways using the Effectopedia platform

April 18
Dr. Russ Kreis, MED, Grosse Ile, MI
- Forecasting the effects of land use change associated with corn production on water and ecosystem quality in the upper midwest

Dr. Jack Kelly, MED
- Selected MED examples and approaches within the SSWR theme, sustainable water resources

April 25: Jo Thompson, MED
- Spatial patterns of Lake Superior phytoplankton

May 2: Professor Jerry Hembd, University of Wisconsin, Superior/Dept. of Business and Economics, and Sustainable Twin Ports

NOTE: For current seminar, see: http://www.epa.gov/med/events.htm.